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U.S. Department of Energy

Performance and Accountability Report Highlights

Fiscal Year 2004

Our Mission

To advance the national, economic and energy security of the United States;

To promote scientific and technological innovation in support of that mission;

To ensure the environmental cleanup of the national nuclear weapons complex.

ABOUT THIS REPORT

This report summarizes the key financial, management and programmatic results presented in the Department's complete Performance and Accountability Report which was issued on November 15, 2004. Both of these documents may be accessed on-line at: http://www.cfo.doe.gov/progliaison/arindex.htm

U.S. Department of Energy

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Managing Our Energy Security

Our History and Mission

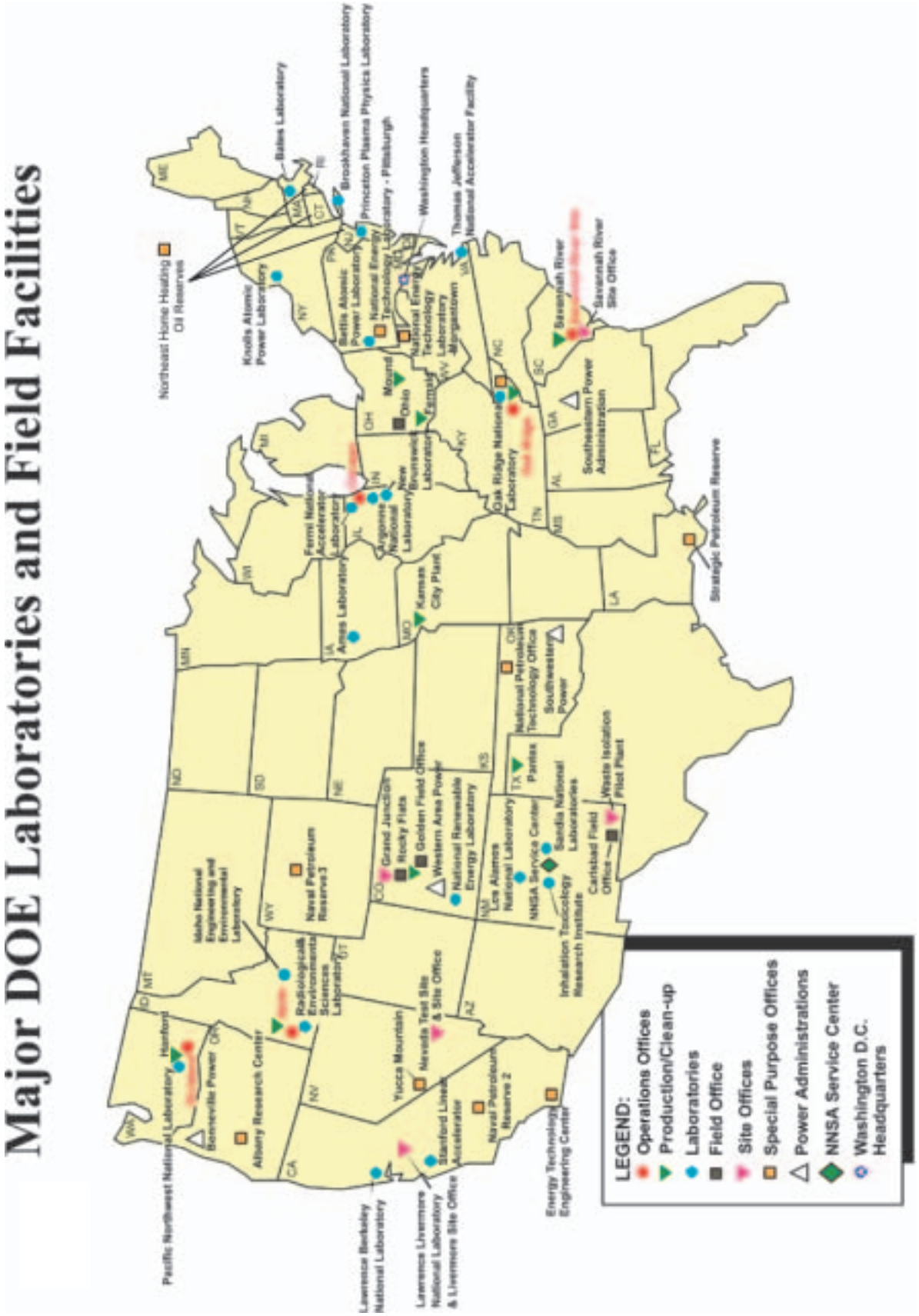
The Department's origins go back to the Manhattan Project and the race to develop an atomic bomb during World War II. Following that war, Congress created the Atomic Energy Commission (1946) to take control over the scientific and industrial complex supporting the Manhattan Project and to maintain civilian government control over atomic research and development.

President Truman signing the Atomic Energy Act and creating the Atomic Energy Commission in August 1946.

In October 1977, Congress passed the Department of Energy Organization Act, creating the Department of Energy. That legislation brought together for the first time not only most of the government's energy programs, but also science and technology programs and defense responsibilities that included the design, construction, and testing of nuclear weapons. Over its history, the Department has shifted its emphasis and focus as the energy needs of the Nation have changed. Since the end of the Cold War, the Department has focused on environmental cleanup of the nuclear weapons complex, nuclear nonproliferation and nuclear weapons stewardship, reliable energy supplies and delivery, energy efficiency and conservation, and the transfer of new technologies between governmental and commercial entities. Today, the Department of Energy contributes to the future of the Nation by ensuring our energy security, maintaining the safety and reliability of our nuclear stockpile, cleaning up the environment from the legacy of the Cold War, and developing innovation in science and technology. The map and charts that follow identify our key facilities and resources supporting our mission.

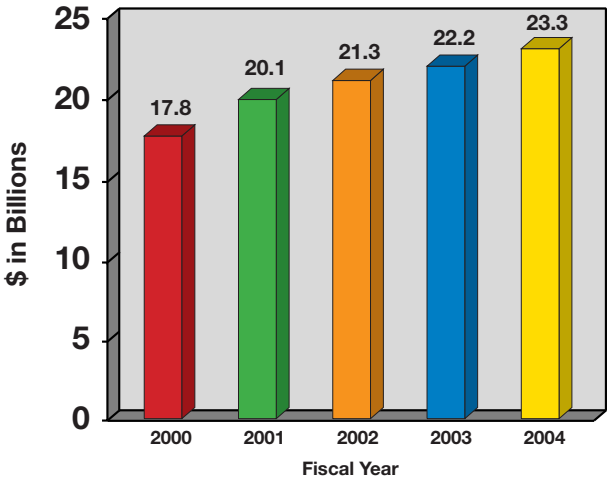
President Carter signing the Department of Energy Organization Act in August 1977.

Offices and Field Facilities

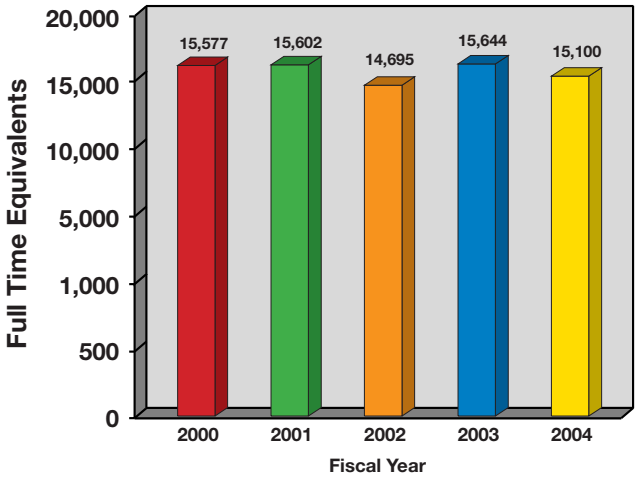


Resources

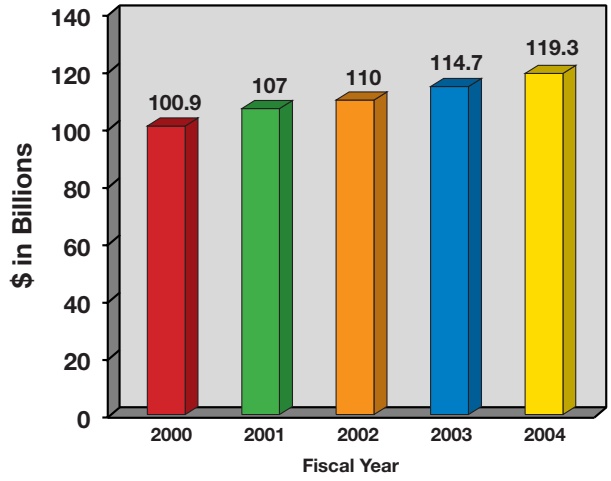
FUNDING



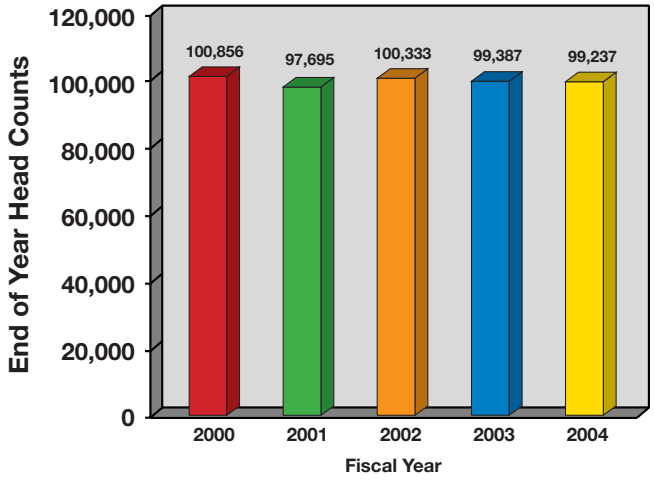
FEDERAL EMPLOYEES



ASSETS



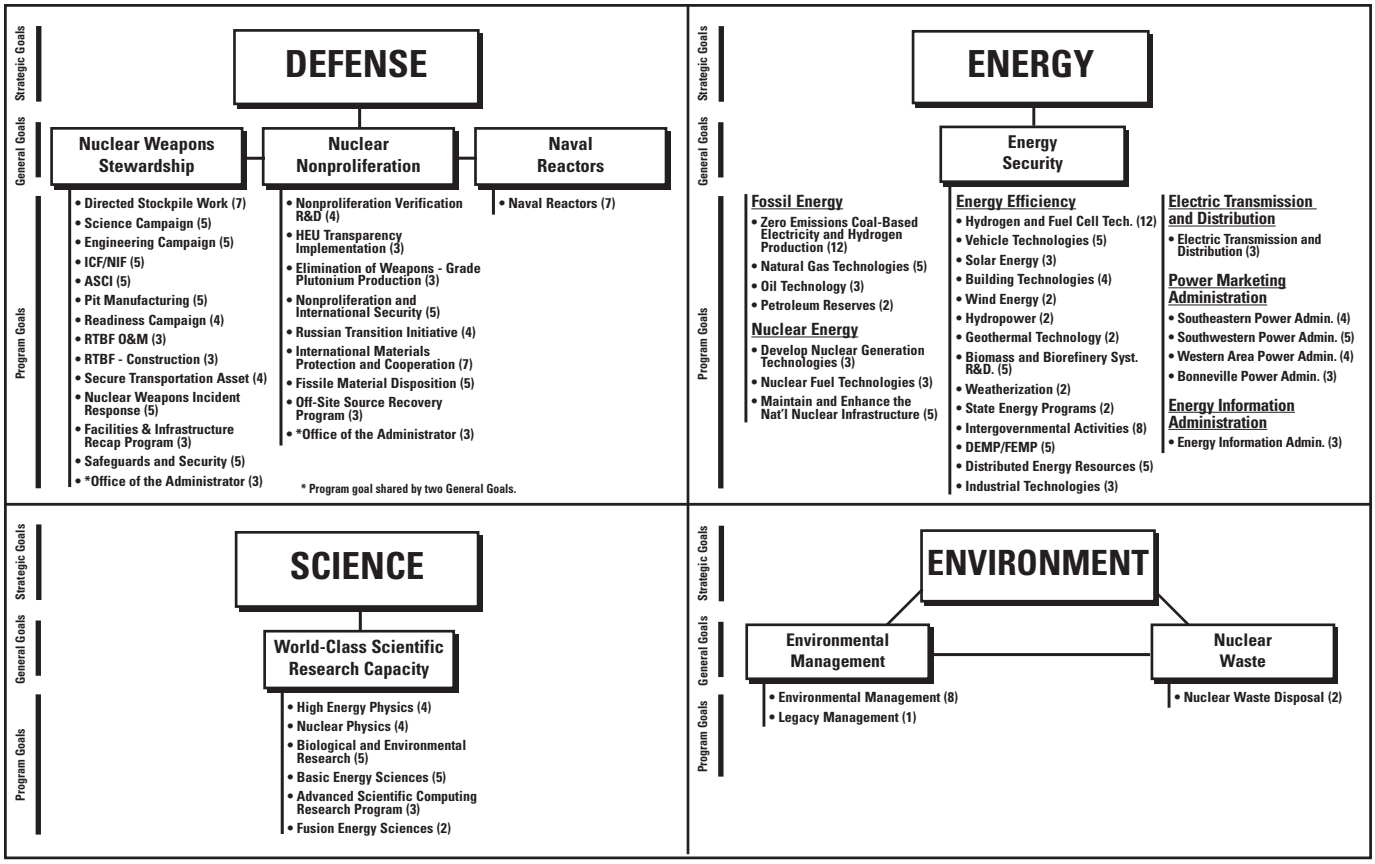
CONTRACTOR EMPLOYEES



Program Performance Highlights

The Department of Energy continues to make significant progress in reaching our long-term strategic goals. We take seriously the challenge to be accountable to the American people for the performance of our programs, and for achieving objectives to strengthen energy and national security. In fiscal year (FY) 2004, the Department carried out its mission through 59 programs with long term (more than one year) goals. These programs are aligned under seven General Goals, which, in turn, support the four Strategic Goals for the Department. The performance of these programs is gauged by 255 annual targets, representing short-term (one year) outcomes (the graph below depicts this hierarchy). The following section highlights, by Strategic Goal, an overview of the Strategic and General Goals, a graphic interpretation of program costs and annual target performance, a description of how our accomplishments serve the public, and a synopsis of key annual target performance and how external factors can impact the overall success of the programs.

Strategic and Performance Goals



Meeting National Security Challenges

Defense Strategic Goal: *To protect our national security by applying advanced science and nuclear technology to the Nation's defense.*

"As beneficiaries of a proud heritage dating from the Manhattan Project, NNSA is building upon an enduring legacy by identifying and embracing its core values: Excellence, Integrity, Respect and Teamwork."

Linton F. Brooks, Administrator
National Nuclear
Security Administration

One of the primary responsibilities of the Department is to enhance national security through the application of nuclear technology. To accomplish this goal, the Department oversees maintenance of the U.S. nuclear weapons stockpile, development of responsive infrastructure that can adapt quickly to stockpile changes while still drawing down the stockpile of weapons excess to defense needs, security of the nuclear complex, strengthening of international nuclear nonproliferation controls, reduction in global danger from weapons of mass destruction, provision to the U.S. Navy of safe and effective nuclear propulsion systems, and operation of its national laboratories. The National Nuclear Security Administration (NNSA) within the Department is responsible for these activities critical to our national security. Three General Goals support the Defense Strategic Goal: Nuclear Weapons Stewardship, Nuclear Nonproliferation, and Naval Reactors.

The B83 weapons assembly shows the complexity of these nuclear weapons.

GENERAL GOAL 1 - NUCLEAR WEAPONS STEWARDSHIP:

Ensure that our nuclear weapons continue to serve their essential deterrence role by maintaining and enhancing the safety, security, and reliability of the U.S. nuclear weapons stockpile.

The most important responsibility of the Secretary of Energy, in cooperation with the Secretary of Defense, is certifying to the President that the Nation's nuclear weapons stockpile is safe, secure, and reliable. To do so, NNSA develops a nuclear weapons stockpile surveillance and engineering capability; refurbishes and extends the lives of selected nuclear systems; and maintains a science and technology base, including the ability to restore the manufacturing infrastructure for the production of replacement weapons, should the need arise. These capabilities ensure the vitality of our nuclear weapons without the need for underground nuclear testing.

GENERAL GOAL 2 - NUCLEAR NONPROLIFERATION:

Provide technical leadership to limit or prevent the spread of materials, technology, and expertise relating to weapons of mass destruction; advance the technologies to detect the proliferation of weapons of mass destruction worldwide; and eliminate or secure inventories of surplus materials and infrastructure usable for nuclear weapons.

NNSA reduces the threat posed by the proliferation of fissile material by helping to secure foreign stockpiles of weapons-grade material. In addition, NNSA oversees the dismantlement, destruction, and ultimate disposition of weapons including the down blending of highly enriched uranium (HEU) or the burning of plutonium as mixed oxide fuel in commercial nuclear power plants. NNSA further reduces risk through controlling exports of nuclear-related technologies, monitoring borders for the movement of fissile materials, and ensuring the employment of foreign nuclear-related scientists and engineers in other more productive pursuits.

NNSA's "Megaports" program provides radiological detector equipment to prevent/detect the movement of materials via cargo ships before they enter U.S. waters.

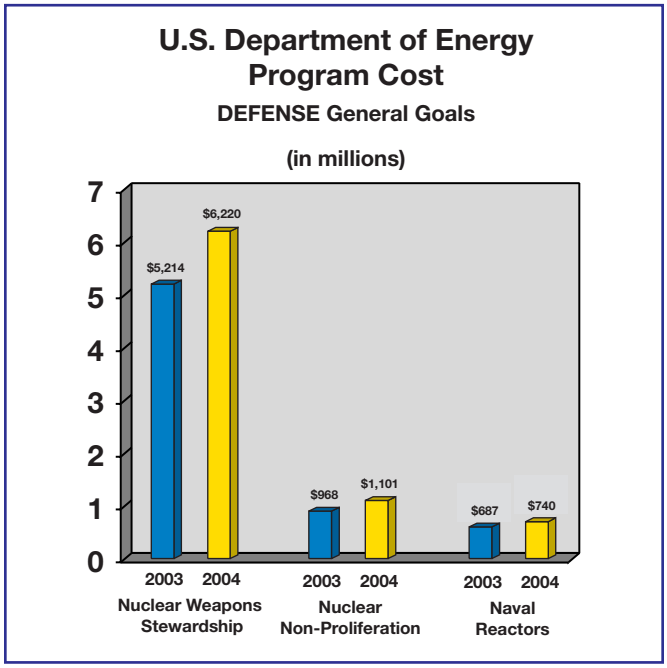
GENERAL GOAL 3 - NAVAL REACTORS:

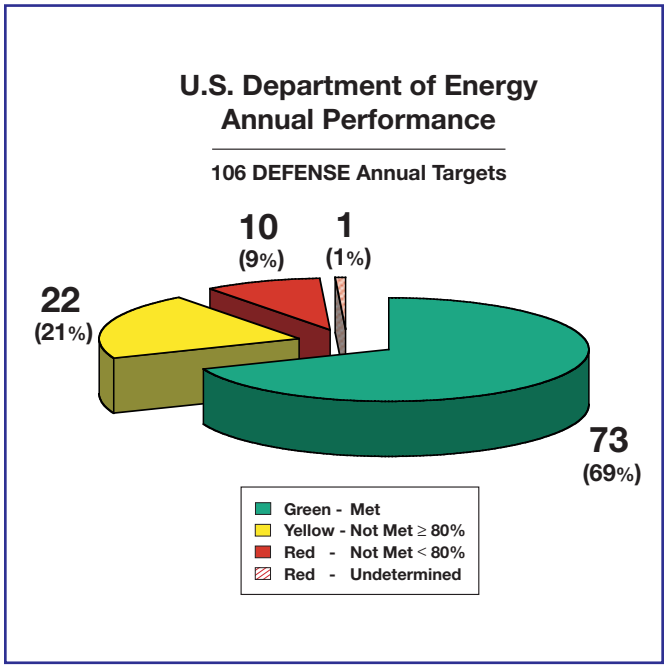
Provide the Navy with safe, militarily effective nuclear propulsion plants and ensure their continued safe and reliable operation.

NNSA is responsible for providing the United States Navy with safe, militarily effective nuclear propulsion plants. Naval nuclear propulsion plants currently power about 40 percent of the Navy's principal combatants. NNSA will continue to provide the Navy and the Department of Defense reliable and militarily effective nuclear power through the Naval Reactors program. New technologies, methods, and materials to support reactor plant design for future generations of reactors for submarines, aircraft carriers, and other combat ships are also developed under this program. Therefore, any external factor seriously affecting either organization's policies may have an impact on the Program's ability to achieve this goal.

NNSA provides the nuclear propulsion system for the Virginia Class attack submarine.

Cost and Performance Overview

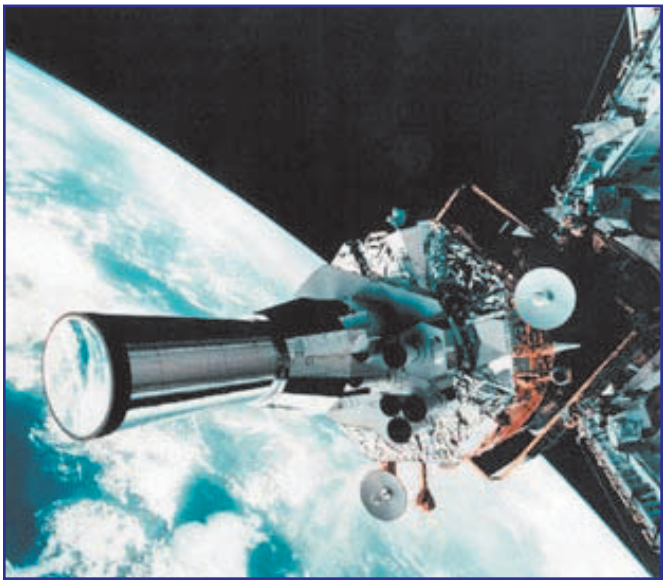




How We Serve the Public

In addition to certification of the nuclear weapons stockpile, NNSA accomplished a number of significant milestones during 2004. These milestones represent activities that enhance nuclear security by using the most economically sound means.

- Completed 100% of the work on the W87 warhead Life Extension Program for the United States Air Force, which avoids the need to produce replacement weapons, providing another cost-effective way to provide nuclear security.
- Reduced the need for underground testing by: (1) attaining a total capacity of Advanced Simulation Computing production platforms of 75 trillion operations per second; (2) beginning operations at the National Ignition Facility (NIF) at limited power in December 2003; and (3) executing the first experiments on the Dual-Axis Radiographic Hydrotest equipment. Together, these activities provide confidence in the reliability of the current nuclear weapons stockpile.
- Completed 90% of the construction phase of the Tritium Extraction Facility. Tritium, a requirement in all U.S. nuclear weapons, must be extracted and replaced periodically to maintain the existing stockpile.
- Authorized projects to reduce the NNSA excess facilities footprint by another 525,000 gross square feet. More than half of the long-range goal reduction of 3 million gross square feet is now underway. This reduction will result in reduced maintenance and security costs.
- Transferred hand-held radiological detection equipment to Greek officials to support increased security for the 2004 summer Olympic Games. The radiation detection equipment was successfully used to detect or deter the illicit trafficking of nuclear and other radiological materials through ports or across international borders.
- Launched sophisticated nuclear test detection sensors in a Defense Support Program (DSP) satellite from Florida's Cape Canaveral on February 14, 2004. This equipment is used to monitor the Limited Test Ban Treaty of 1963 and to deter proliferant nations from conducting nuclear tests. The next DSP satellite, scheduled for launch in 2005, will complete the present nuclear detection sensor package design and also carry the demonstration experiment for the next generation of high altitude sensors – the Space and Atmospheric Burst Reporting System that NNSA is currently developing.



The DSP supports nuclear test detection from space.

- Initiated a new program to provide employment opportunities to Iraqi scientists, technicians, and engineers. This program complements other Bush Administration initiatives that seek to prevent the proliferation of weapons of mass destruction expertise to terrorists or proliferant states.
- Continued security upgrades on weapons usable nuclear material. A quarter of the targeted 600 metric tons is now secure, thereby enhancing the security of our Nation.
- Created or expanded 16 commercial enterprises and employed 8,200 Russian scientists and engineers formerly employed in nuclear weapons facilities located in Russia. Similar to the aforementioned Iraqi reconstruction effort, the employment of these skilled nuclear-trained professionals in such endeavors as medical technology helps prevent the spread of sensitive knowledge to rogue states.
- Provided confidence, as part of the 1993 HEU Purchase Agreement, that Russian HEU is permanently eliminated from the Russian stockpile. Russian HEU was down blended into low-enriched uranium (less than 5% U235 assay) and sold to the U.S. Enrichment Corporation. Through FY 2004, 231 metric tons of HEU, equivalent to 9,240 nuclear weapons, have been eliminated as part of 500 metric tons being eliminated by 2013.
- Recovered approximately 10,022 sealed sources of high-risk radiological sources, thereby preventing these radioactive materials from being used in a radiological dispersal device, also known as a "dirty bomb."
- Completed the next-generation submarine reactor plant design.

Performance of Key Targets

- Successfully completed with the Department of Defense, the surety and assessment reports to support certification on the nuclear weapons stockpile.
- Remained on track to complete construction of NIF which will create and measure extreme temperature and pressure conditions of a simulated nuclear explosion by 2008. However, in 2004, 12% of the equipment to support ignition experiments at the facility were fabricated, versus a goal of 16%. The missed milestone has been rescheduled to the second quarter, FY 2005.

Secure Transportation Asset Convoy Vehicle ensures safe and secure warhead movements.

- Completed 91 secure convoys that provided the safe and secure transport of nuclear weapons, components, and materials.
- Installed radioactive detection equipment in 66 sites to prevent and detect the illicit transfer of nuclear material. Although the cumulative goal of 74 sites was not achieved, pace of implementation should increase in the first

quarter of FY 2005 as Memoranda of Understanding with foreign governments are signed.

- Completed 12.9 percent of a fossil fuel plant in Seversk, Russia, which would facilitate shutting down two weapons-grade plutonium production reactors. The annual target of 16 percent was not achieved due to the increase of preliminary cost assessments. Additional funding in 2005 will place this project back on track.
- Accomplished 15 percent of U.S. assistance to the Russian Federation of the mixed oxide fuel facility design. The resolution of a liability issue involving provisions for contractors working in Russia prevented the completion of the 60 percent target. Resolution is currently being pursued by all affected agencies (e.g. DOE, DOD, and State) at the National Security Council level.
- Achieved two million miles of safe steaming in nuclear-powered ships. Since its inception, the Naval Reactors program has supplied 130 million miles of safe nuclear propulsion.

External Factors

The following external factors could affect our ability to achieve these goals:

- **Technology:** Technological development is inherently unpredictable. The discovery of an insurmountable scientific or engineering obstacle in a credible science-based stockpile stewardship program could force the resumption of underground nuclear testing.

  Our efforts to develop nuclear weapons/material detection technology may be more or less successful than predicted, which would have a corresponding positive or negative impact on our efforts.
- **Nuclear Threats:** Changes in the nuclear threats posed to the United States could require changes to our nuclear weapons stewardship programs.
- **Close Cooperation with Russia:** Unprecedented levels of cooperation between the United States and Russia have made it possible to take great strides in securing and eliminating inventories of surplus materials. A close relationship is necessary for future progress.
- **International Atomic Energy Agency (IAEA):** The IAEA is essential to the success of our efforts to control nuclear proliferation. It is uncertain whether the IAEA will receive the necessary funding and show the necessary leadership to member countries. We are monitoring this situation closely.

Investing In America's Energy Future

Energy Strategic Goal: *To protect our national and economic security by promoting a diverse supply and delivery of reliable, affordable, and environmentally sound energy.*

This solar dish-engine system is an electric generator that "burns" sunlight instead of gas or coal to produce electricity. The dish, a concentrator, is the primary solar component of the system, collecting the energy coming directly from the sun and concentrating it on a small area. A thermal receiver absorbs the concentrated beam of solar energy, converts it to heat, and transfers the heat to the engine/generator.

In 2001, President Bush put forth a National Energy Policy to help America improve our energy security. Science and technology are the Department's principal tools for achieving the goals of the National Energy Policy. The Department invests in high-risk, high-value energy research and development that the private sector alone would not or could not develop in a market-driven economy. We are developing technologies to allow renewable energy to play a more important role in the future of our Nation.

GENERAL GOAL 4 - ENERGY SECURITY:

Improve energy security by developing technologies that foster a diverse supply of reliable, affordable, and environmentally sound energy by providing for reliable delivery of energy, guarding against energy emergencies, exploring advanced technologies that make a fundamental improvement in our mix of energy options, and improving energy efficiency.

The following Offices within the Department are working toward the energy security goal:

The Office of Fossil Energy addresses issues related to the security, affordability, and environmental acceptability of fossil fuel supply and use.

The Office of Nuclear Energy, Science and Technology leads the government's efforts to develop new nuclear energy generation technologies to meet energy and climate goals; to develop advanced, proliferation-resistant nuclear fuel technologies that maximize energy from nuclear fuel; and to maintain and enhance the national nuclear technology infrastructure.

The Office of Energy Efficiency and Renewable Energy's mission is to strengthen America's energy security, environmental quality, and economic vitality through public-private partnerships that promote energy efficiency and productivity, bring clean, reliable and affordable energy technologies to the marketplace, and make a difference in the everyday lives of Americans by enhancing their energy choices and quality of life.

The mission of the Office of Electric Transmission and Distribution is to lead a national effort to modernize and expand America's electric delivery system to ensure a more reliable and robust electricity supply, as well as economic and national security. Accomplishment of this mission will help guard against energy emergencies or disruptions.

The Power Marketing Administrations market and deliver reliable, cost-based Federal hydroelectric power and related services to customers over much of the southeastern, central and western United States.

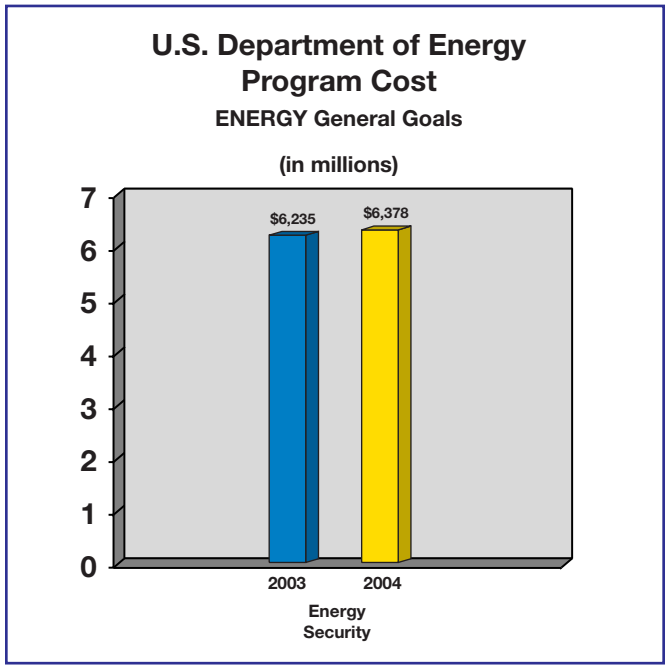
The Department's technologies draw on all our available resources: oil; natural gas; coal; nuclear energy; renewable energy sources including hydropower, wind, solar, bioenergy, and geothermal; and reductions in demand through conservation and energy efficiency technologies and processes.

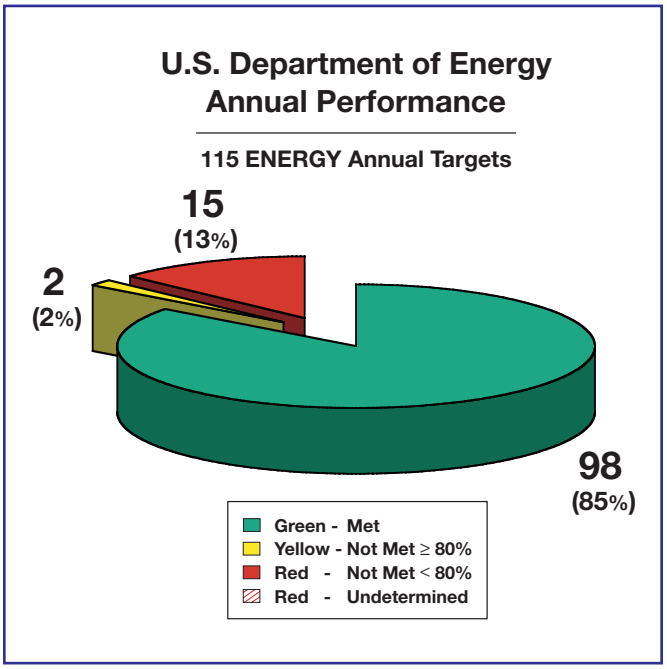
How We Serve the Public

The programs that contribute to this General Goal are involved in a broad range of projects and other activities that seek to merge cutting edge technologies with responsible energy practices. Examples of how each has served the public throughout FY 2004 include:

- Conducted research and development to enhance our recoverable oil and natural gas resources. By improving exploration and drilling technologies, this could decrease our reliance on foreign sources of energy by increasing the total recoverable domestic resources of oil and gas.
- Provided the following: 1) next-generation reactor technologies for producing electricity and hydrogen using nuclear power more efficiently and safely; 2) advanced fuel cycle technologies for reducing the volume and radiotoxicity, and increasing the proliferation-resistance of spent nuclear fuel, making nuclear energy more economical and environmentally friendly; 3) plutonium-based heat and power systems for the National Aeronautics and Space Administration's deep space exploration missions; 4) research and medical isotopes needed by a variety of paying customers; and, 5) nuclear reactor fuel and reactor upgrades to universities across the Nation, as well as financial assistance to nuclear engineering and science undergraduates and graduate students.

Cost and Performance Overview



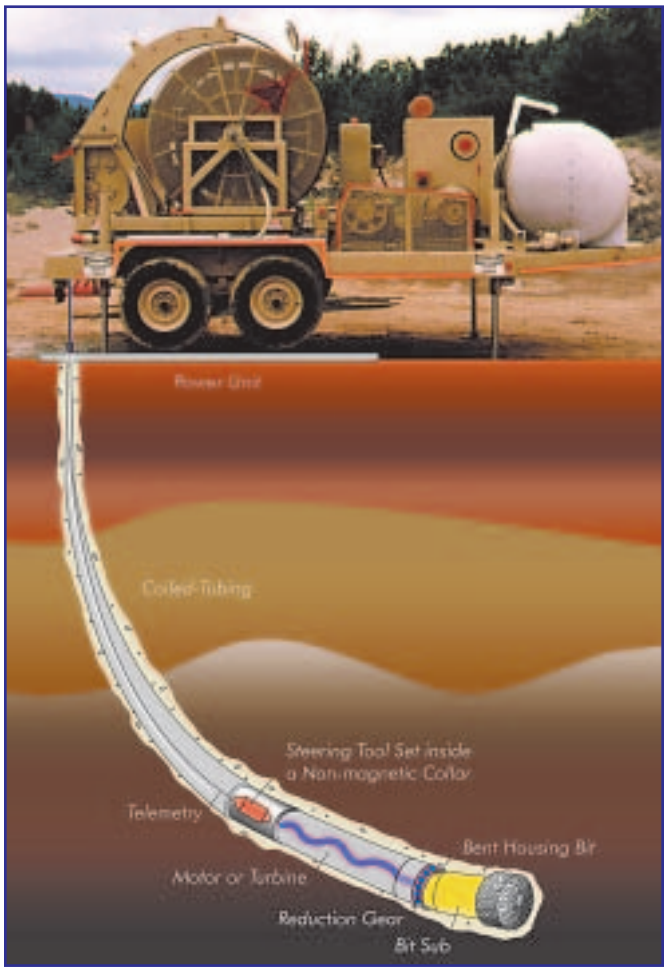


Cooperative arrangements at all levels of government illustrate the Department's commitment to responsible energy use. These include:

- Signed an agreement formally establishing the International Partnership for the Hydrogen Economy (IPHE). The IPHE is an international mechanism to coordinate hydrogen research and hydrogen technology development and deployment.
- Initiated a new effort to educate state and local government officials on the vision of a hydrogen economy. "Hydrogen Power: The Promise, The Challenge" is a six-city national tour that commenced in Lansing, Michigan on March 23, 2004. The Department offers "Hydrogen 101" to State and local officials who do not have a technical background, but are interested in learning more about hydrogen and fuel cell technologies, hydrogen safety, and the challenges to achieving the hydrogen vision.
- Honored winners of the 2004 EnergyStar© Partner of the Year awards. These awards highlight the efforts of leading manufacturers, retailers, utility companies, and a variety of state and regional programs that promote energy efficiency and awareness of the EnergyStar©.
- Led the modernization and expansion of the Nation's electricity delivery system (the grid).
- Provided on-going delivery of reliable low cost power and related services to many hundreds of customers including municipalities, cooperatives, public utility and irrigation districts, Federal and State agencies, and Native American tribes. The marketing efforts and delivery capabilities of the Power Marketing Administrations provide for recovery of annual operating costs as well as repayment of taxpayer investment in the Federal hydropower system.

Performance of Key Targets

- Initiated testing on membrane technology that would separate hydrogen from gasified coal which could then be used as an environmentally friendly fuel for power generation. Further technologies will be developed to increase domestic supplies from unconventional sources, such as methane hydrates.
- Completed laboratory studies and feasibility analyses in the areas of drilling vibration monitoring and control and high-temperature electronics. Specifications were developed for high temperature silicon to be used on key insulator components. In addition, simulation software was completed which integrated 3-D seismic data offering enhanced capabilities to locate new natural gas deposits.
- Conducted innovative research (see Microhole Systems diagram) for enhanced oil recovery technologies, improved computer simulation software to better identify hydrocarbon targets, and initiated a fracture development timing study for Alaska's Brook Range to further characterize the location and availability of oil reserves in Alaska.

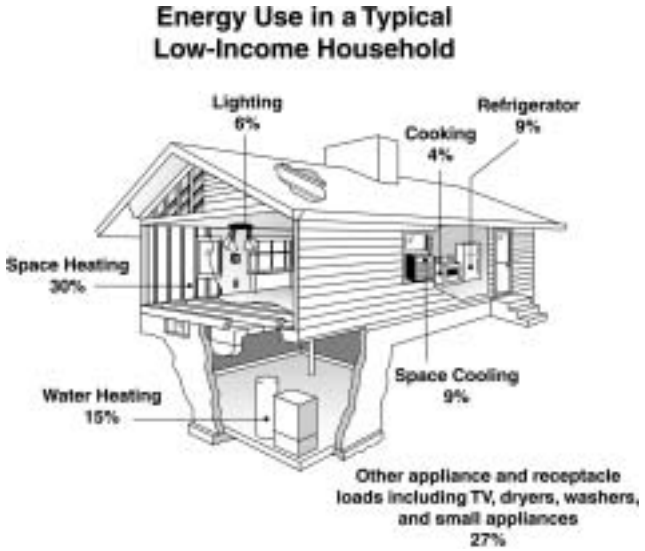


Microhole Systems *One way to potentially lower the relatively high costs of locating and producing hydrocarbons in the United States may be to reduce the size of the borehole and the equipment needed to drill it. This program is exploring new concepts for miniaturized drilling systems.*

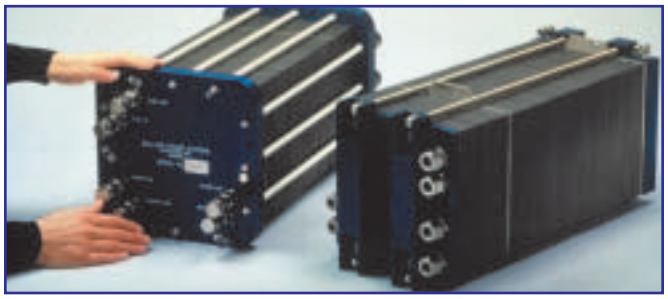
"The Strategic Petroleum Reserve is an important element of our Nation's energy security. To maximize long-term protection against oil supply disruptions, I am directing...the Secretary of Energy to fill the SPR up to its 700 million barrel capacity."

President George W. Bush
November 13, 2001

- Added 46 million barrels to the Strategic Petroleum Reserve resulting in a total inventory of 670 million barrels. This capacity provides 56 days of net import protection.
- Received three financial assistance applications for nuclear power plant licensing demonstration projects in response to the Nuclear Power 2010 program solicitation.
- Demonstrated the separation of long-lived radioisotopes from spent nuclear fuel at laboratory scale.
- Completed the final designs of the baseline thermochemical and high-temperature electrolysis laboratory-scale experiments.
- Provided fuel to research reactors, funded 26 industry-matching grants, provided 20 equipment and instrumentation upgrades, and provided 51 nuclear engineering education research grants, 21 fellowships, and 54 scholarships. These accomplishments are key to ensuring that highly-talented nuclear engineers and scientists enter the workforce to meet current and future U.S. demand.
- Maintained and operated the radioisotope power systems facilities with less than 10 percent unscheduled downtime from the approved FY 2004 baseline.
- Achieved the cost-competitive target of $200 per kilowatt for a hydrogen fueled 50 kilowatt fuel cell power system.
- Verified the efficiency of commercial modules used in converting solar energy to electrical energy.
- Reduced the high power, light vehicle lithium ion battery cost to $964 per battery system.
- Weatherized 99,614 homes through the Department's Weatherization Assistance Program. This program has provided services to more than 5.4 million low-income families.



- Completed testing of prototypes for the first advanced low wind-speed technology components, and detailed designs under the first public-private partnership project for full system low wind speed turbine development.
- Installed a prototype wide-area measurement system that is operating in the Nation's Eastern Interconnection with 12 time-synchronized monitoring instruments that feed data into two data archiving and analysis locations.
- Power Marketing Administrations achieved North American Electric Reliability Council standards and operated power systems reliably and efficiently.

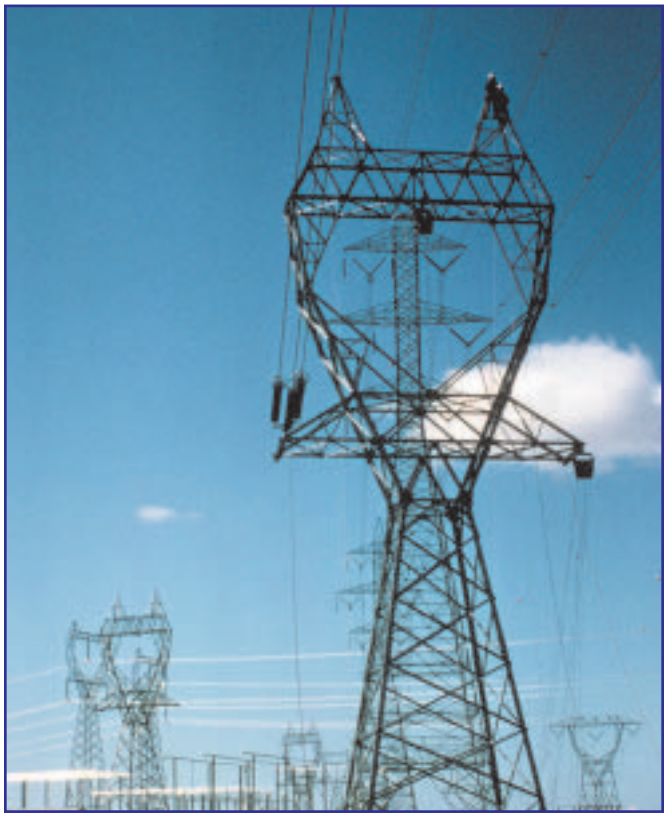


A fuel cell uses the chemical energy of hydrogen to produce electricity and water, cleanly and efficiently.

External Factors

The following external factors could affect our ability to achieve this goal:

- **Technology:** Technological development is inherently unpredictable. Our efforts to develop zero-emission fossil generation technology, hydrogen, renewable energy, and advanced nuclear power may be more or less successful than predicted, with a correspondingly positive or negative impact on our efforts.
- **Market Forces:** Whether new technology is deployed depends to a large extent on whether that technology is competitive, considering relevant policies (e.g., tax incentives for the purchase of fuel-cell vehicles) and future energy prices.
- **Consumer Choice:** Improved energy efficiency is largely the result of millions of decisions by individual consumers. The Department can help develop improved technology, but whether this technology is deployed depends on consumer decisions, including the market price of energy and relevant policies that may affect those decisions. In addition, the deployment of hydrogen and alternative fueled vehicles depends to a large extent on the decisions by individual consumers to purchase these vehicles.
- **Nonproliferation Policy:** Deployment of advanced fuel cycle technologies will depend upon policy changes permitting fuel reprocessing.



Grid modernization is a substantial undertaking because America's electric systems are capital-intensive and far-reaching:

- *10,000 power plants generate electricity*
- *157,000 miles of high voltage transmission lines deliver electricity*
- *3,100 utilities distribute electricity*
- *131 million commercial, industrial, and residential customers use electricity*

Advancing Scientific Understanding

Science Strategic Goal: *To protect our national and economic security by providing world-class scientific research capacity and advancing scientific knowledge.*

"Scientific and technological research are a high calling for any individual. And promoting research is an important role of our Federal government. . . . We'll continue to support science and technology because innovation makes America stronger. Innovation helps Americans to live longer, healthier, and happier lives. Innovation helps our economy grow, and helps people find work. Innovation strengthens our national defense and our homeland security. . . ."

President George W. Bush

Basic scientific research in the physical sciences is one of the foundations for economic growth and national security in this country. Achievements and benefits in areas such as public health, telecommunications, and supercomputing are dependent upon progress in the physical sciences. The Department's Office of Science is a primary government sponsor of basic scientific research in the U.S., and leads the Nation in supporting the physical sciences in a broad array of research subjects to improve our Nation's energy security and to address issues ancillary to energy, such as climate change, genomics, and life sciences.

A single General Goal supports the Science Strategic Goal: World-Class Scientific Research Capacity.

GENERAL GOAL 5 - SCIENCE:

Provide world-class scientific research capacity needed to ensure the success of Departmental missions in national and energy security; to advance the frontiers of knowledge in physical sciences and areas of biological, medical, environmental, and computational sciences; or provide world-class research facilities for the Nation's science enterprise.

The common thread woven throughout all of the Department's activities is science – basic research underpins the Department's applied technology programs through strategic investments that fuel discoveries in materials sciences, chemistry, plasma science, plant sciences, biology, computation and environmental studies.

The Office of Science plays five key roles in the U.S. research enterprise:

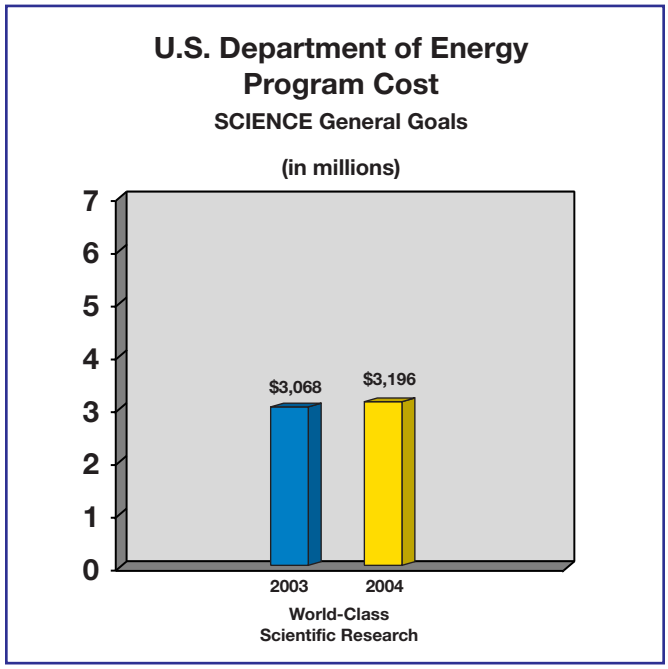
- Supports the missions of the Department, delivering the scientific knowledge for solutions to our Nation's most critical energy and environmental challenges;

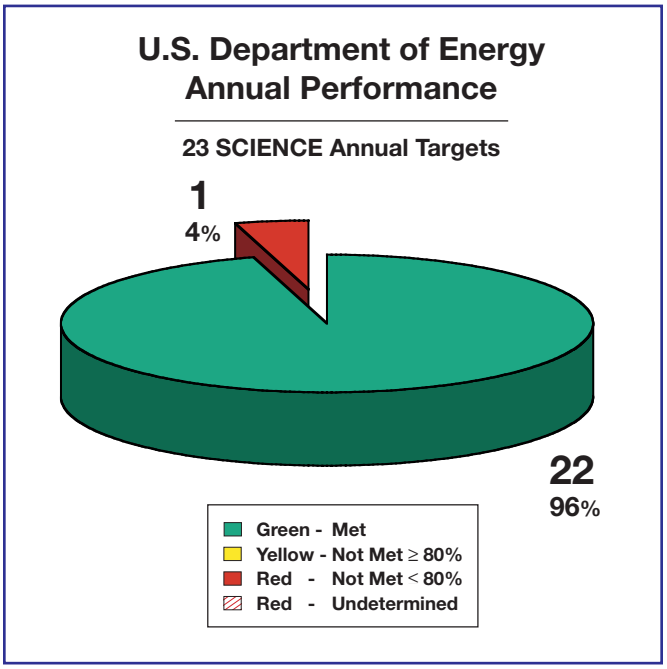
- Acts as the Nation's leading supporter of the physical sciences, including physics, chemistry and materials science;
- Maintains stewardship of world-class scientific tools – building and operating major research facilities for use by the world's scientific community;
- Serves as a key Federal agency for the creation of leadership class computational facilities for open science, enabling solutions to problems in science and industry not attainable by simple extrapolation of existing architectures; and,
- Supports a diverse set of researchers, including those at more than 280 universities in every state in the Nation as well as scientists and technicians at the Department's national laboratories and in industry.

How We Serve the Public

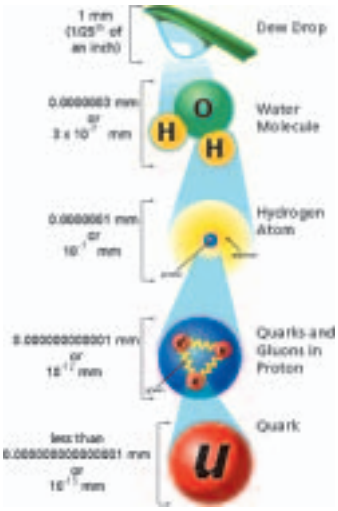
The investments in the most basic areas of research spark our imagination and advance our human curiosity about the universe in which we live. Historically, these investments have also paid handsome dividends in terms of new technologies that have raised our standard of living and even extended our life expectancy. For instance, the youngest school child today thinks nothing of working on a personal computer, which is based upon state-of-the-art electronics. Life-threatening ailments are imaged, diagnosed, and treated without having to resort to surgery. And people can speak clearly to others halfway around the world using a phone barely the size of a human hand. One day, our current efforts supporting the development of an artificial retina may help some blind people see. It is also interesting to note that many of the great scientific advances of the last century resulted from experiments that yielded results that were completely different from what theory had predicted. Today, those successful "failures" have led to a new understanding of the microscopic structure of matter and to the technology so essential to modern life.

Cost and Performance Overview





The Building Blocks of a Dew Drop and The Standard Model: Quarks, Leptons, and Bosons



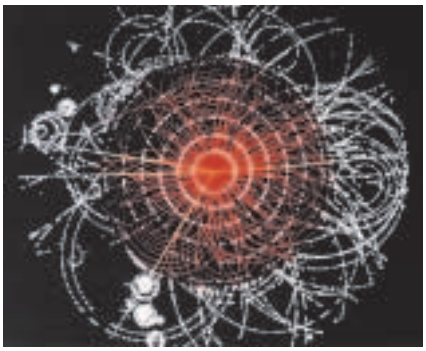
A dew drop is made up of many molecules of water (10^{21} or a billion trillion). Each molecule is made of an oxygen atom and two hydrogen atoms (H_2O). At the start of the 20th century, atoms were the smallest known building blocks of matter.

Each atom consists of a nucleus surrounded by electrons. Electrons are leptons that are bound to the nucleus by photons, which are bosons. The nucleus of a hydrogen atom is just a single proton. Protons consist of three quarks. In the proton, gluons hold the quarks together just as photons hold the electron to the nucleus in the atom. Physicists call the theoretical framework that describes the interactions between elementary building blocks (quarks and leptons) and the force carriers (bosons) the Standard Model.

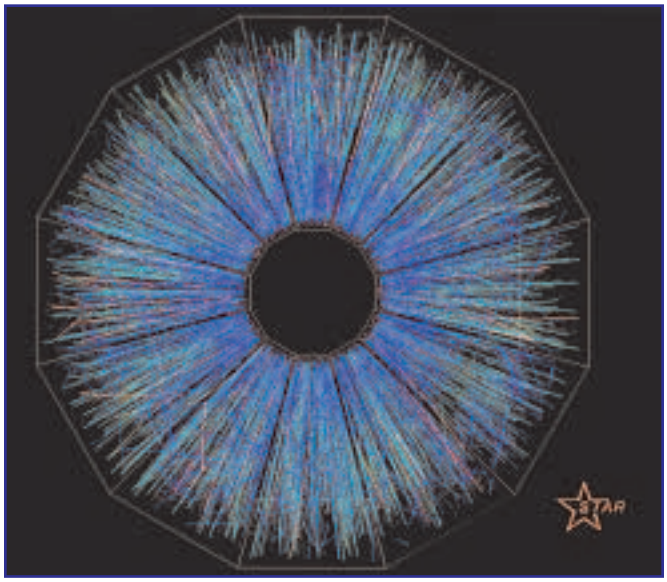
The Standard Model:

Physicists currently believe there are three types of basic building blocks of matter: quarks, leptons, and bosons. Quarks and leptons make up everyday matter, which is held together by bosons. Each boson is associated with a force. The photon, the unit of the electromagnetic force, holds the electron to the nucleus in the atom. The way these particles combine dictates the structure of matter.

Proving the Existence of the Higgs Field by Finding the Higgs Boson



A computer simulation depicts the decay of a Higgs boson, which is believed to give mass to elementary particles, into four muons.



End view of a collision of gold beams in STAR detector at BNL's Relativistic Heavy Ion Collider (RHIC).

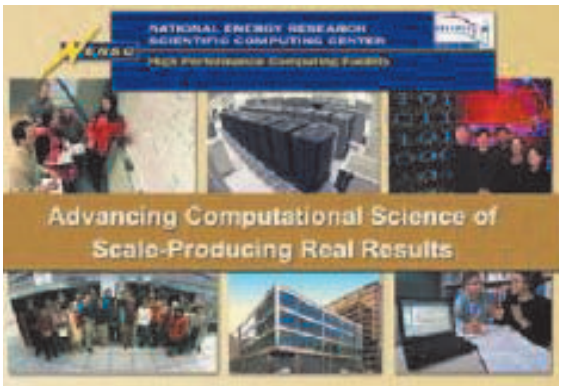
Performance of Key Targets

- Operated the Tevatron accelerator and associated detectors at the Fermi National Accelerator Laboratory for 36 weeks at higher data rates in search for the "fingerprints" of unification – such as the Higgs boson, the expected source of mass (see Higgs boson insert). The higher data rate achieved, measured by increased luminosity, enhanced researchers' ability to make precise measurements and discover new phenomena.
- Met or exceeded the target number of events for accelerator experiments at the following facilities: the Continuous Electron Beam Accelerator Facility at Thomas Jefferson National Accelerator Facility in Newport News, Virginia; the Relativistic Heavy Ion Collider at Brookhaven National Laboratory in New York (see insert above); the Argonne Tandem Linac Accelerator System at Argonne National Laboratory in Illinois; and the Holifield Radioactive Ion Beam Facility at Oak Ridge National Laboratory in Tennessee.
- Continued efforts in the development of improved methods of climate data collection, and improved model-based climate prediction capability.

How Does the Artificial Retina Work?

The implant has pieces both inside and outside the eye. Patients wear glasses, like those shown on the left, with a tiny camera embedded in the lens. The camera captures images and sends the data to a microprocessor (concealed in the side of the glasses) which converts the data to an electronic signal. An antenna in the lens transmits the signal to a receiving antenna in the eye. The signal then travels along a tiny wire to the retinal implant. The signal causes the implant to stimulate the remaining retinal cells which send the image along the optic nerve to the brain.

- Fabricated a 60 microelectrode array for use as an artificial retina and completed planned animal testing (see insert above).
- Continued support of nine scientific user facilities at near maximum operating levels. Designed, fabricated, and constructed new facilities within established cost and schedule baselines to characterize and ultimately control materials.
- Maintained an average operation time of 90 percent for its three primary collaborative facilities (see Major Collaborative Facilities insert): The DIII-D at General Atomics in San Diego, the Alcator C-Mod at MIT, and the National Spherical Tokamak Experiment at Princeton.

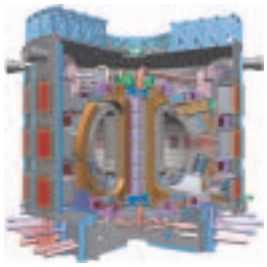


***The National Energy Research Scientific Computing (NERSC) Center**, managed and operated by Lawrence Berkeley National Laboratory, is a world leader in accelerating scientific discovery through computation.*

- Observed particle interactions at the Stanford Linear Accelerator Center for 39 weeks in 2004. This focused effort resulted in higher data rates, measured by increased luminosity, which enhanced researchers' ability to analyze data.
- Increased the rate of Deoxyribonucleic Acid (DNA) sequencing, which accelerated our microbial research.
- Improved the resolving strength of scientific instruments in order to measure smaller structures and faster events.

Major Collaborative Facilities

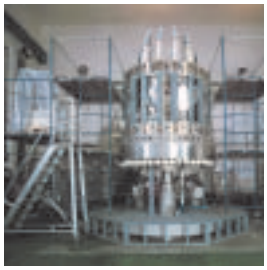
***The Future: ITER.** The US is engaging in negotiations with international partners aimed at constructing the world's first sustained burning plasma experiment, capable of producing 500 million watts of fusion power for periods of 5 minutes or more.*



***DIII-D,General Atomics,** is the largest magnetic fusion research facility in the United States, with plasmas at close to fusion reactor temperatures.*

***NSTX, Princeton Plasma Physics Laboratory,** is an innovative magnetic fusion device that was constructed by the Princeton Plasma Physics Laboratory in collaboration with the Oak Ridge National Laboratory, Columbia University, and the University of Washington, Seattle.*

***Alcator-C-Mod, Massachusetts Institute of Technology,** is a unique, compact-tokamak facility that uses intense magnetic fields to confine high-temperature, high-density plasmas in a small volume.*



External Factors

The following external factors could affect our ability to achieve this goal:

- **Scientific and Technical Talent:** The prospect of insufficient scientific and technical talent, now and in the foreseeable future, threatens our ability to maintain world-class scientific capacity.
- **National Support for Science:** Eroding national support for investments in the physical sciences that provide the critical foundations to virtually all other fields of science, and the rapidly growing dependency between the biological and physical sciences.

Resolving the Environmental Legacy

Environment Strategic Goal: *To protect the environment by providing a responsible resolution to the environmental legacy of the Cold War and by providing for the permanent disposal of the Nation's high-level radioactive waste.*

Brookhaven National Laboratory: Inside the newly constructed Industrial Park East Groundwater Treatment System, Stefano Ciafani, an environmental engineer learns how granulated carbon is used to absorb contaminants from groundwater.

The Department's Environmental Management program was established in 1989 to clean up the contamination from fifty years of America's nuclear defense work and energy research operations and dispose of the waste in a manner that protects the environment, the workers, and the public. Over the last three years, the program has delivered significant risk reduction and cleanup results while ensuring that the cleanup is safe for workers, protective of the environment and respectful of the taxpayer. These outcomes are providing benefits to the public, our communities, and for generations to come. The Department has two General goals that support the Environment Strategic goal: Environmental Management and Nuclear Waste.

GENERAL GOAL 6 – ENVIRONMENTAL MANAGEMENT:

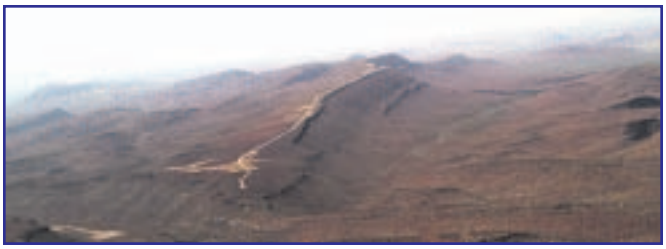
Accelerate cleanup of nuclear weapons manufacturing and testing sites, completing cleanup of 108 contaminated sites by 2025.

In August 2001, the Secretary of Energy directed a "Top-to-Bottom" review of the environmental cleanup program, which was completed in February 2002. The review concluded that significant change was required in how the Department attacked risk reduction and cleanup. The environmental cleanup program stood as one of the largest liabilities of the Federal Government. The top priority for the program has been to reform and refocus the nuclear weapons cleanup program to deliver risk reduction safer and faster and to clean up more efficiently and cost effectively. The Department, working collaboratively with the regulator and stakeholder community, is developing strategies to focus cleanup activities on accelerated risk reduction and site closure.

GENERAL GOAL 7 – NUCLEAR WASTE:

License and construct a permanent repository for nuclear waste at Yucca Mountain and begin acceptance of waste.

Associated with the Nation's energy supply is the Federal responsibility for the ultimate repository for spent nuclear fuel (SNF) and high-level radioactive waste (HLW). This responsibility includes licensing, building, and operating a deep geologic repository at Yucca Mountain, Nevada, for the disposal of both commercial and the Department's SNF, HLW, and surplus fissile materials. Implementing this goal is the responsibility of the Office of Civilian Radioactive Waste Management. After more than two decades of scientific study, President Bush signed the joint Congressional Resolution designating Yucca Mountain, Nevada, as the site of the Nation's first geologic repository for HLW and SNF in July 2002.



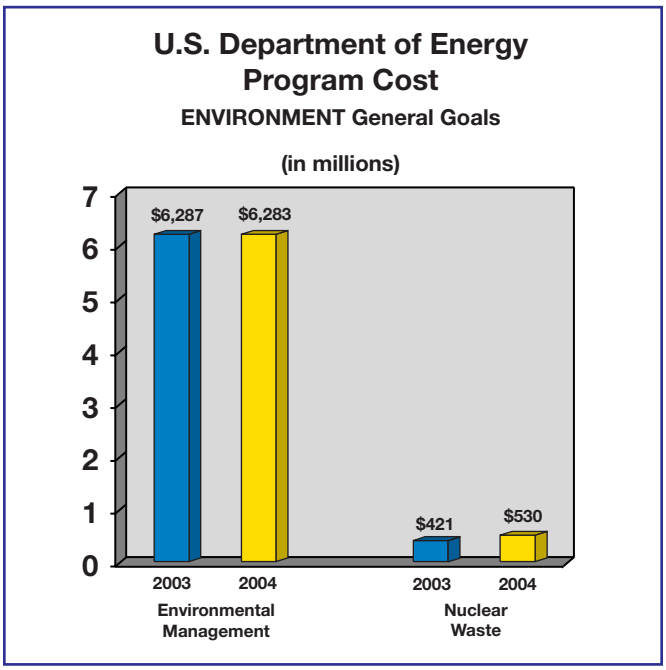
Radioactive Waste Repository site, Yucca Mountain, Nevada

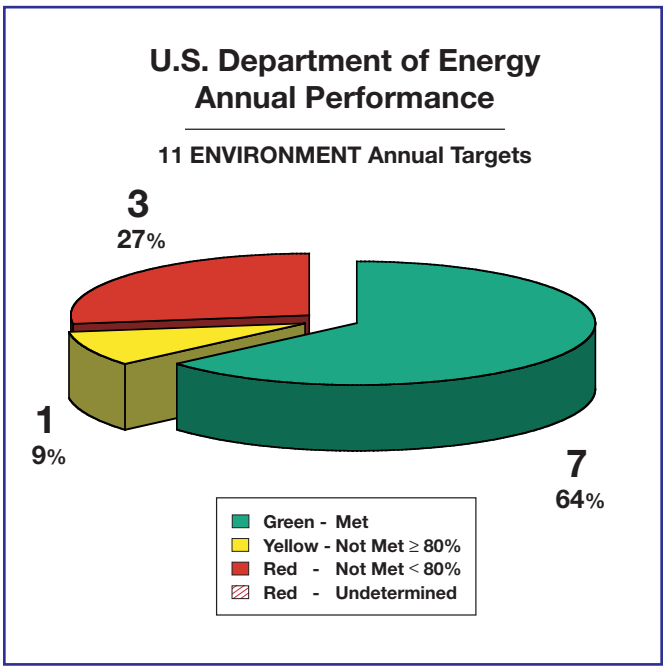
How We Serve the Public

The Department is addressing the legacy of more than 50 years of nuclear weapons production and nuclear power research and development. The scope of the environmental program includes stabilization and disposition of some of the most hazardous materials known to man. The cleanup program results from over five decades of nuclear weapons production and energy research and is the largest active cleanup program in the world, encompassing over two million acres at 114 geographic sites.

In FY 2003 and FY 2004, the Department increased resource investments to focus on accelerated cleanup and risk reduction. This has allowed the Department to lower fixed infrastructure costs, complete work, reduce high cost security areas and pull work forward, thus allowing a greater portion of funds to go to cleanup. As of September 2004, the cleanup of 76 geographic sites has been completed. The Department plans to complete two geographic sites in 2005 (Amchitka Island and the Laboratory for Energy-Related Health Research) and ten geographic sites in 2006 (Rocky Flats Environmental Technology Site; Miamisburg Environmental Project; Fernald Environmental Project; Lawrence Berkeley National Laboratory; Stanford Linear Accelerator Center; Ashtabula

Cost and Performance Overview





Environmental Management Project; Columbus Environmental Management Project – West Jefferson; Kansas City Plant; Lawrence Livermore National Laboratory – Main Site; and Sandia National Laboratory). By 2025, remediation at 108 geographic sites will be completed, leaving six to be addressed after 2025.

For more than half a century, the U.S. has been generating SNF and HLW by using materials to produce electricity, power naval vessels, perform research and development, and develop nuclear weapons. These materials are currently stored in temporary facilities at some 125 sites in 39 states. More than 160 million Americans live within 75 miles of one or more of these sites. The nuclear waste disposal program, mandated by the Nuclear Waste Policy Act of 1982, as amended, is a key priority for the Administration. The ultimate consolidation and disposal of nuclear waste at Yucca Mountain will support national security and energy security, reducing the number of locations where nuclear materials are stored. Nuclear waste disposal is also essential for maintaining the viability of the commercial nuclear power industry, which currently supplies more than 20 percent of the Nation's electricity. Congress has indicated that continued support for nuclear power development is contingent upon successfully establishing the repository.

Performance of Key Targets

- Made significant progress in the packaging of plutonium metal or oxide containers for long-term storage and has consistently completed more actual work than planned over the past three years. Continued progress made in packaging bulk plutonium or uranium residue. In FY 2002 and FY 2003, the actual completion was above the planned targets resulting in completing the planned FY 2004 target quantity earlier than expected. In FY 2004, all remaining plutonium materials were packaged and removed from the Rocky Flats site, which dramatically reduced the site security costs as well as the safety and health risk to workers and the public.
- Delayed closing of liquid tanks as a result of the litigation concerning the Department's Waste Incidental to Reprocessing authority. The FY 2005 National Defense Authorization Act provides a statutory mechanism that allows DOE to resume tank closure at the Savannah River Site and the Idaho National Laboratory.
- Resolved prior year technical problems that allowed the Environmental Management program to exceed the annual target for preparing the Department's spent nuclear fuel for final disposition to ensure the material was ready for disposal in the federal geologic repository.
- Accelerated remediation of release sites (discrete areas of contamination) at Rocky Flats, Hanford and Sandia National Laboratory, thereby completing remediation of 300 release sites. This exceeded the annual target of 200 release sites for this measure. Completing remediation of release sites is a key factor in completing a geographic site, which best reflects the Department's goal of accelerating cleanup and reducing risk.
- Made progress on completing a high quality defensible license application (including the underlying scientific technical and design work) that meets regulatory requirements, merits the Nuclear Regulatory Commission's (NRC) confidence, and provides the basis for beginning repository operations.

External Factors

The following external factors could affect our ability to achieve these goals:

- **Regulatory Requirements:** Compliance with environmental laws and regulations, agreements with state and federal regulators, and legal decisions drive the Department's cleanup approaches. Laws and regulations are subject to change, agreements with states require renegotiation, and legal decisions can alter strategic frameworks.

  The NRC is responsible for approving the license application for Yucca Mountain. Any delay in issuing a license could subsequently delay the commencement of repository operations. The action of the Federal Court of Appeals in July 2004, vacating the 10,000-year compliance period in the EPA regulations for Yucca Mountain, introduces additional uncertainty with respect to

the final regulatory requirements needed for a licensing decision. In addition, in August 2004, an NRC panel vacated the Department's initial certification of its Licensing Support Network (LSN) material that is being made available for discovery purposes. Certification of the LSN is a prerequisite for submitting a license application.

- **Cleanup Standards:** The end state for cleanup at certain sites is not fully determined. The extent of cleanup greatly affects cost, schedule and scope of work.
- **Technology:** Suitable cleanup technologies do not always currently exist, and the development and deployment of innovative technologies could help reduce risk, lower cost, and accelerate cleanup.
- **Uncertain Work Scope:** Uncertainties are inherent in the environmental cleanup program due to the complexity and nature of the work. There are uncertainties in our knowledge of the types of contaminants, their extent, and concentrations.
- **Commercially Available Options for Waste Disposal:** Accomplishment of accelerated risk reduction and site closure is dependent upon the continued availability of commercial options for mixed low-level waste and low-level waste disposal.
- **Litigation:** It is likely that any new EPA Standard and any NRC decision to issue a license to construct and operate a repository at Yucca Mountain will be challenged in the courts. The outcomes of a number of pending lawsuits by the state of Nevada, local jurisdictions, and others also pose schedule and financial risks to the program.
- **Congressional Funding:** In Fiscal Year 2005, and beyond, the nuclear waste disposal program will need a significant increase in funding to pay for the design, construction and operation of the repository and for the transportation infrastructure. Although the annual receipts and accumulated balance in the Nuclear Waste Fund are sufficient to fund current needs, budget processes have severely limited access to those funds.

Corporate Management

The President's Management Agenda

In 2001, the President challenged the Federal Government to become more efficient, more effective, more results-oriented and more accountable to our fellow citizens. Over the past three years, this initiative, called the President's Management Agenda (PMA), has become the framework for organizing our efforts and focusing on the bottom line. This agenda reflects the President's commitment to achieve immediate, concrete, and measurable results that matter to the American people. Each agency is accountable for its performance and is rated by the Office of Management and Budget (OMB) through a quarterly scorecard.

The Department of Energy has met the President's challenge. When the first scorecard was issued in 2002, the Department was one of the lowest-rated agencies in the Federal Government. Two years later, in FY 2004, OMB ranked the Department of Energy as one of the top cabinet-level agencies in demonstrating progress in implementing the PMA. Key examples of our management improvement initiatives included consolidating business and administrative support functions to achieve economies of scale, developing comprehensive workforce and succession management plans, restructuring our performance management system to link achievement to mission accomplishment, and conducting competitive sourcing and re-engineering activities that will save taxpayers millions of dollars.

In FY 2005, the Department plans to continue our success in the areas in which we have achieved a green status and aggressively pursue excellence in the remaining initiatives.

FY 2004 PMA Scorecard

Initiative	Status	Progress
Strategic Management of Human Capital – Ensuring that our organization has the right people with the right skills in the right places at the right time to achieve their goals.	Green	Green
Competitive Sourcing – Opening up the government and its functions to competition, not only with the private sector but with other units of Government, will lead to better performance and better value for the taxpayer.	Green	Green
Improved Financial Performance – Providing Federal managers with accurate, timely and useful financial data for making decisions that achieve efficiencies while improving the lives of the American people.	Green	Green
Expanded Electronic Government – Utilizing information technology to make Government services more available to citizens, reduce burdensome paperwork, and lower costs.	Yellow	Green
Budget and Performance Integration – Basing budget and management decisions on whether a program is delivering the services promised in an efficient and effective manner.	Green	Green
Federal Real Property Asset Management – Using sound business practices to manage the Department's multi-billion dollar real estate portfolio.	Red	Green
Research that Solves Problems – Ensuring that the Department's research facilities are making the greatest possible contribution to our nation and energy security.	Red	Green

Significant Issues Facing the Department

The Department of Energy carries out multiple complex and highly diverse missions while complying with many laws and regulations. During FY 2004, we ensured compliance with the Federal Managers' Financial Integrity Act of 1982 (FMFIA) and the Federal Financial Management Improvement Act of 1996 (FFMIA). The Department did not identify any material weaknesses that place the overall control system at risk nor did the Department identify any instances of noncompliance with our financial management systems. For more detailed information on the results of our FMFIA and FFMIA reviews, please see the complete Performance and Accountability Report located on our website (www.energy.gov). Although the Department is continually striving to improve the efficiency and effectiveness of its programs and operations, there are specific areas within our operations that merit a higher level of focus and attention. These areas represent the most significant issues we have in accomplishing our mission. Based on our review of the critical activities within the Department of Energy, we identified nine "Significant Issues" that we believe represent the most important matters facing the Department now and in the coming years. The following chart provides information on these significant issues.

Fiscal Year 2004 Significant Issues

Significant Issue	Expected Completion
Oversight of Contractors – Improvements are needed in the oversight of contractors managing and operating the Department's facilities.	Long-term
Security – Physical and cyber security challenges need to be re-assessed and strengthened due to the events of September 11, 2001.	Long-term
Environmental Cleanup – Long-term compliance and waste management issues that pose risks to the environment.	Long-term
Stockpile Stewardship – The Department must enhance activities to ensure the safety and reliability of our nuclear weapons stockpile.	Fiscal Year 2006
Information Technology Management – Significant problems have impeded the Department's ability to effectively manage its information technology resources.	Fiscal Year 2005
Project Management – The Department needs to improve processes for baseline changes to projects and develop an approach to project manager certification.	Fiscal Year 2007
Human Capital Management – Develop a corporate strategy for reinvesting our human capital to ensure that the right skills necessary to successfully meet our missions are available.	Fiscal Year 2006
Safety and Health – Ensure that adequate focus on general safety at our laboratories and plants is maintained.	Fiscal Year 2005
Nuclear Waste Disposal – A repository for the Nation's spent nuclear fuel and high-level radioactive waste has not been opened as required by the Nuclear Waste Policy Act.	Long-term

Inspector General Reporting

Reports issued by the Office of the Inspector General provide opportunities for positive change throughout the Department. During fiscal year 2004, the Department took final action on 88 Inspector General reports, including eight operational, financial, and pre-award audit reports.

Audit Reports	Number of Reports	Agreed-Upon Funds Put to Better Use ($ in Millions)
Pending final action at the beginning of the period	120	$ 3,680
With actions agreed upon during the period	62	$ 0
Total pending final action	182	$ 3,680
Achieving final action during the period	88	$ 2,580 *
Requiring final action at the and of the period	94	$ 1,100

*Reflects single Agreed-Upon Funds Put to Better Use also included in the Office of the Inspector General's semi-annual report.

Government Accountability Office Reporting

The U.S. Government Accountability Office (GAO) audits are a major component of the Department's audit follow-up program. At the beginning of fiscal year 2004 there were 27 GAO audit reports awaiting final action. During fiscal year 2004, GAO issued 41 additional audit reports. Of the 41 reports, 18 required tracking of corrective actions and 23 did not because the report did not include actions to be taken by the Department. We completed agreed upon corrective actions on 9 audit reports during 2004. At the end of 2004, there were 36 GAO reports awaiting final action.

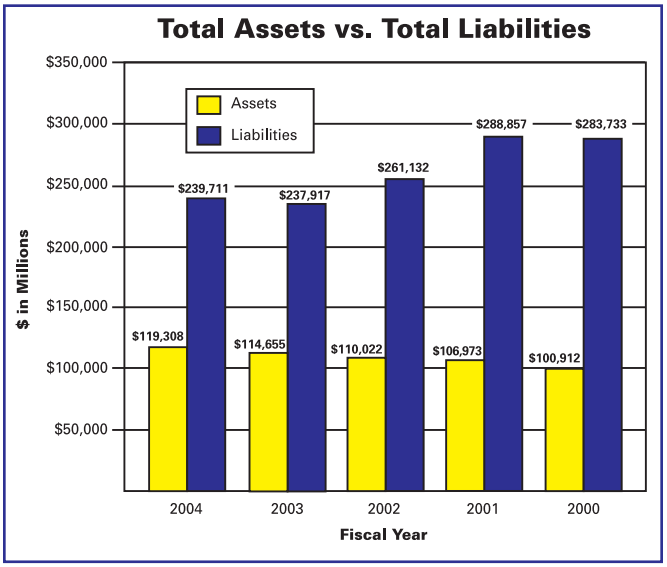
Financial Highlights

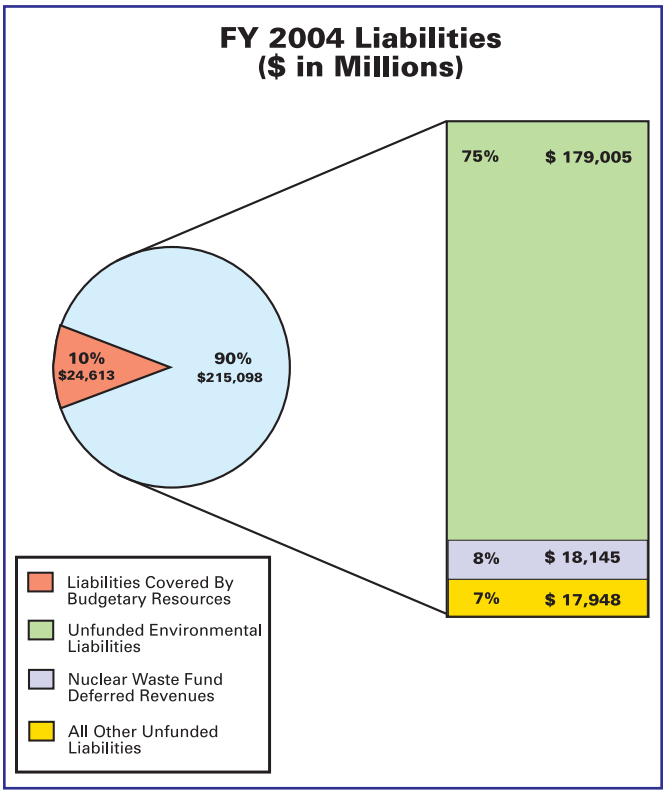
The Department's financial statements received an unqualified audit opinion from KPMG LLP. Preparing these statements is part of the Department's goal to improve financial management and provide accurate and reliable information that is useful for assessing performance and allocating resources. The Department's management is responsible for the integrity and objectivity of the financial information presented in these financial statements.

Balance Sheet. The Department has significant unfunded liabilities that will require future appropriations to fund. The most significant of these represent ongoing efforts to clean up environmental contamination resulting from past operations of the nuclear weapons complex. The FY 2004 environmental liability estimate totaled $182 billion and represents one of the most technically challenging and complex cleanup efforts in the world. Estimating this liability requires making assumptions about future activities and is inherently uncertain. The future course of the Department's environmental management program will depend on a number of fundamental technical and policy choices, many of which have not been made. The cost and environmental implications of alternative choices can be profound.

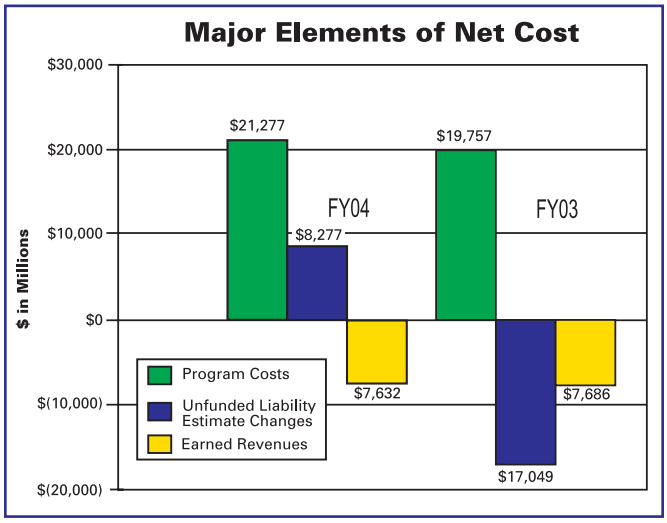
Cleanup estimates have been reduced in the past few years primarily due to the Department's efforts to restructure the environmental program to focus on risk and accelerate cleanup goals, and the expenditure of $6 - $7 billion per year on actual cleanup work.

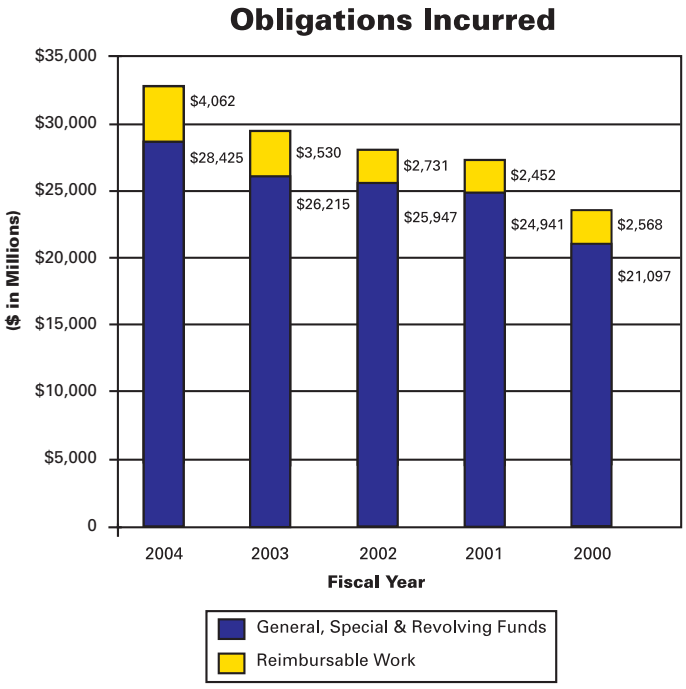
Net Cost of Operations. The major elements of net cost include program costs, unfunded liability estimate changes, and earned revenues. Unfunded liability estimate changes result from inflation adjustments; improved and updated estimates; revisions in acquisition strategies, technical approach, or scope; and regulatory changes. The Department's overall net costs are dramatically impacted by these changes in environmental and other unfunded liability estimates. Since these estimates primarily relate to the cost of prior years operations, they are not included as current year program costs.

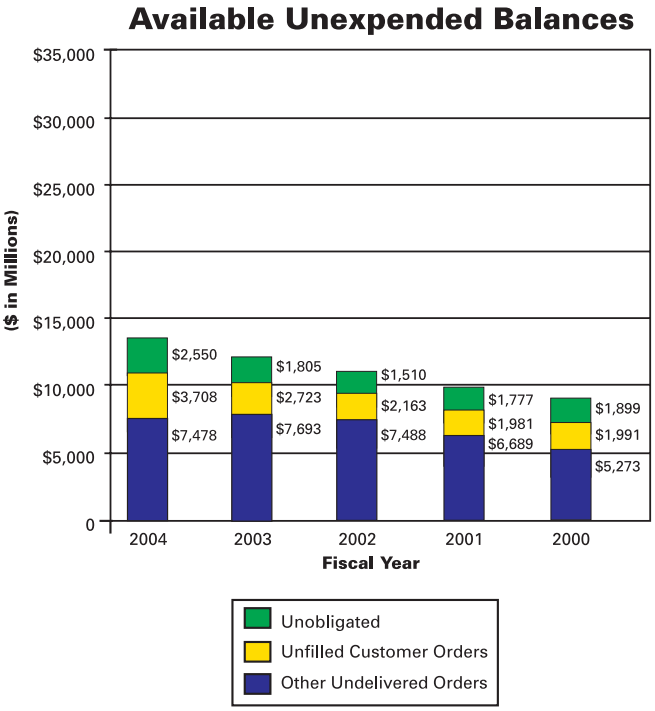




Budgetary Resources. The Department receives most of its funding from general government funds administered by the Department of the Treasury and appropriated for Energy's use by Congress. Since budgetary accounting rules and financial accounting rules may recognize certain transactions at different points in time, Appropriations Used on the Consolidated Statements of Changes in Net Position will not match costs for that period. The primary difference results from recognition of costs related to changes in unfunded liability estimates.







"Our commitment to the American people is to manage their resources wisely and effectively. I believe you will find our performance demonstrates that the Department of Energy takes this responsibility seriously and, through a sustained focus on results, is working diligently to ensure that taxpayers' dollars are well managed."

Susan J. Grant
Director,
Office of Management,
Budget and Evaluation/CFO

www.energy.gov